

LA-UR-21-22573

Approved for public release; distribution is unlimited.

Title: Spin Susceptibility in Neutron Matter from QMC Calculations

Author(s): Lonardonì, Diego

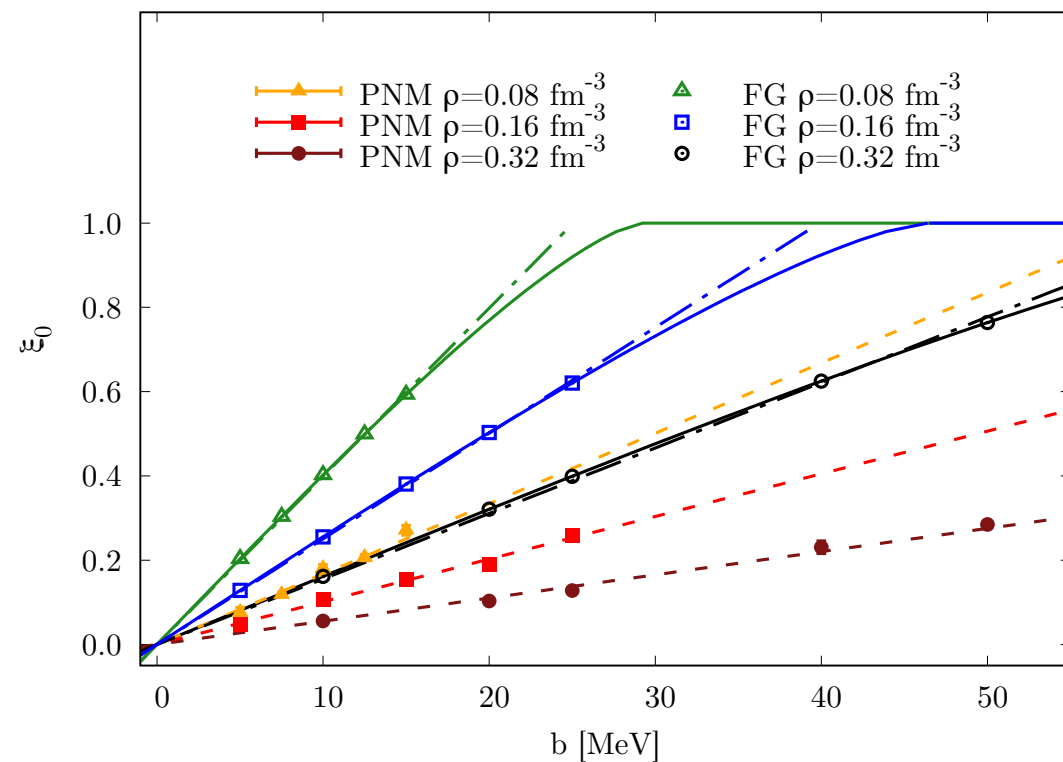
Intended for: One-Page Publication Highlights

Issued: 2021-03-16

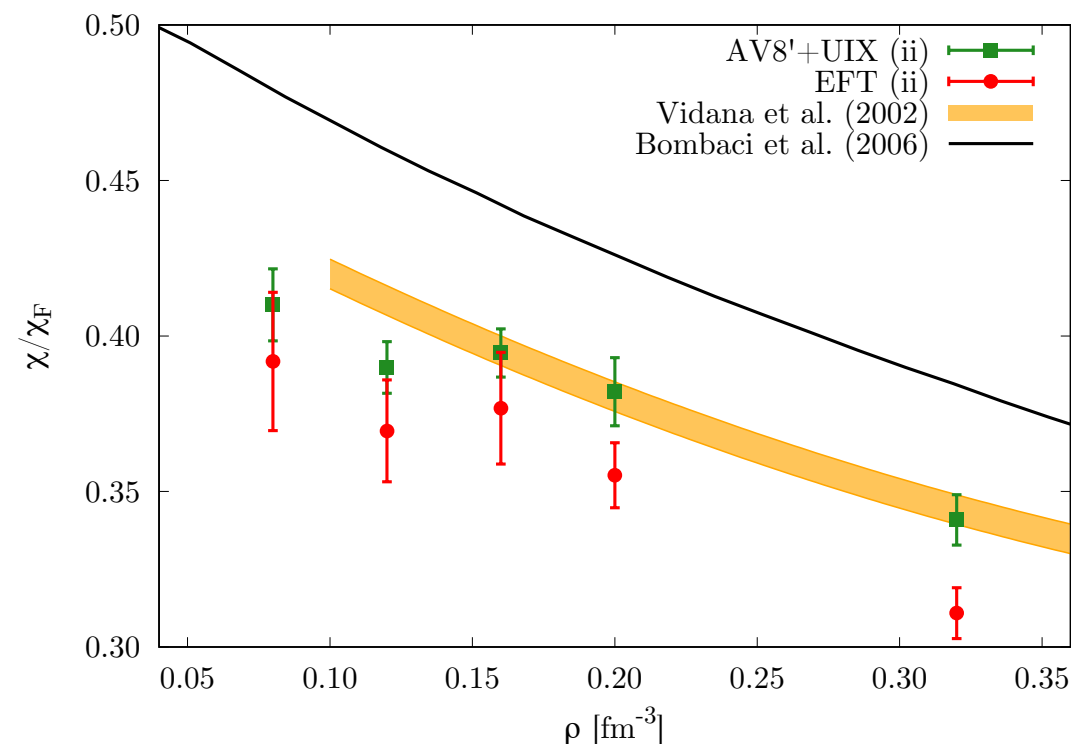
Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Spin Susceptibility in Neutron Matter from QMC Calculations



Ground-state polarization as a function of the external magnetic field in PNM and the free Fermi gas.



Spin susceptibility in PNM as a function of the density.

Objectives

- We study the spin susceptibility in pure neutron matter (PNM) using quantum Monte Carlo (QMC) techniques.
- We employ both phenomenological potentials and interactions derived from chiral effective field theory.
- We perform calculations for different spin asymmetries, and we use twist-averaged boundary conditions to reduce finite-size effects.

Impact

- We find that the predicted ground-state polarization of the interacting system (PNM) is much lower than the one predicted for the free Fermi gas.
- We find that three-body forces have a 10-15% effect on the predicted PNM spin susceptibility. However, realistic Hamiltonians provide consistent results regardless the scheme of the nuclear interaction.
- Accurate results for the spin susceptibility are needed for general relativity simulations of violent phenomena, such as supernova explosions or neutron star mergers.

Accomplishments

- L. Riz, F. Pederiva, D. Lonardoni, and S. Gandolfi, [Particles](#) **2020**, 3(4), 706-718